REMARKS

By this amendment, applicants have amended claim 1 to recite 1 that the plural primary particles are of planar type and have amended claims 10 and 15 to recite that the plurality of primary particles are composed of planar crystals. These amendments are supported by, e.g., the disclosure at page 6, lines 20-23 of Applicants' specification. Applicants have also added new claims 19-21 to define further aspects of the present invention. See, e.g., page 5, lines 13-18 of Applicants' specification.

Claims 1, 6, 10, 12, 15 and 17 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Japanese Patent Application Publication Number JP-2001-243951 (Matsumoto et al.) in view of International Application Publication Number WO 03/044881 (Shiozaki et al.). Applicants traverse this rejection and request reconsideration thereof.

The present invention relates to a positive electrode material and to a lithium secondary battery for an automobile comprising the positive electrode material. The positive electrode material includes plural primary particles of planar type flocculated to form a secondary particle. That is, the primary particles are composed of planar crystals having a structure of a composite oxide represented by $Li_aMn_xNi_yCo_zO_2$ wherein $1 \leq a \leq 1.2$, $0 \leq x \leq 0.65$, $0.33 \leq y < 0.5$, $0 \leq z \leq 0.65$ and $x+y+z=1$, the primary particles being flocculated and linked to form the secondary particle. According to the present invention, the length in which the plural primary particles are linked on the section of the secondary particles equivalent to 10 to 70% of the length of the whole periphery on the section of the plural primary particles. This provides a voidage of the secondary particle of 2.5 to 35% (see, claims 14, 16 and 18), preferably 2.5 to 10% (see claims 19-21).

Japanese Patent Publication 2001-243951 (Matsumoto et al.) discloses a positive electrode active material for a non-aqueous electrolyte secondary battery, which is comprised of secondary particles, each of secondary particle being composed of fine primary particle of lithium cobalt oxide. At least a part of the fine primary particles in a secondary particle are arranged in radiation toward outside from the center of the secondary particles. The secondary particles have many fine gaps among primary particles, in which the electrolyte can infiltrate.

It is submitted Matsumoto et al. publication does not disclose, either expressly or inherently, a positive electrode material made of plural primary particles of planar type flocculated to form a secondary particle, the length in which the plural primary particles are linked on the section of the secondary particle being equivalent to 10 to 70% of the length of the whole periphery on the section of the plural primary particles.

In Matsumoto et al., while it is disclosed that the aggregated secondary particle can have spherical an ellipse shape, it appears from the English language machine translation of 0013 of Matsumoto et al. (available on the JPO website) that the primary particles may be spherical. Whatever the shape of the primary particles of Matsumoto et al., however, the primary particles are arranged in radial directions in the secondary particles, gaps among primary particles vary from the center of the secondary particle to the periphery portion.

At the center of the secondary particle, gaps among primary particles are relatively small, but, at the periphery portion of the secondary particle, gaps among primary particles are relatively large, as shown in the Sheet No. 3 attached to Applicants' Amendment and Submission Under 37 CFR 1.114 filed January 21, 2009. Accordingly, since the contact areas among primary particles are relatively large at the center of the secondary particle of Matsumoto et al., the primary

particles at the center of the secondary particle may be cracked due to volume change caused by incoming and outgoing of lithium ions during charge/discharge. Such a crack of the primary particles at the center of the secondary particle decreases the life span of battery.

Since the contact areas among primary particles are relatively large at the periphery of the second particle of Matsumoto et al., the gaps among the primary particles at the periphery of the secondary particle can maintain electrolyte. However, by sintering at least part of the primary particles, electric conductivity and particle density can be improved. In applicants' arguments filed June 9, 2008, applicants explained the gaps among primary particles at the center of the secondary particle of Matsumoto et al., and then explained the gaps at the periphery of the secondary particle. These explanations are not contradictory, as alleged the paragraph bridging pages 4 and 5 of the Office Action.

The Examiner has previously alleged that the sintering temperature 900ºC of Matsumoto is very close to the lower limit 950ºC of the sintering temperature disclosed in Applicants' specification in connection with the manner in which the present invention is made. Further, it is contended that the results of the present invention have not been adequately demonstrated in comparison with the disclosure of Matsumoto et al.

Generally, however, a small difference of sintering temperature produces different products as explained in Applicants' Amendment and Submission Under 37 CFR. 1.114 filed January 21, 2009, with reference to the Sheet Nos. 1 and 2 attached thereto.

In numbered section 4 of the Office Action on page 6, the Office Action appears to dispute Applicants' statement that a small difference in sintering temperature produces different products as shown with reference to Sheets 1 and 2.

Applicants are submitting herewith the Declaration Under 37 CFR 1.132 of Toyotaka Yuasa. As indicated in section 4 of the Declaration, measurements were conducted of the primary particle sizes of the powder shown in Sheets 1 and 2, with the result that the average primary particle size of the powder shown in Sheet 1 is 0.2868 μm an the average primary particle size of the powders shown in Sheet 2 is 0.6165 μm. For the reasons given in the Declaration, it is concluded that the sintering temperature difference of 70ºC produces different products (see numbered section 7 of the Declaration).

The Shiozaki et al. publication discloses a positive electrode active material for a lithium secondary cell having a high energy density and excellent in charging/discharging cycle performance, and a lithium secondary cell having a high energy density and excellent in charging/discharging cycle performance are disclosed. A positive electrode active material for a lithium secondary cell is characterized in that the composition of the active material is $Li_xMn_aNi_bCo_cO_2$ (where a, b, and c are values of a point (a, b, c) on a side of or inside a quadrilateral ABCD having vertexes A(0.5, 0.5, 0), B(0.55, 0.45, 0), C(0.55, 0.15, 0.30), and D(0.15, 0.15, 0.7) on a ternary state diagram showing the relationship among a, b, and c, and satisfy the expressions $0.95<x/(a+b+c)<1.35$) and in that the active material contains a composite oxide having an α-$NaFeO_2$ structure. The lithium secondary cell comprises this active material.

By determining only the voidage of secondary particle, it is not possible to avoid primary particles which have small contact areas among primary particles. In manufacturing positive electrode material, such secondary particles which include primary particles having relatively small contact areas are inevitably produced.

To improve electron conductivity, it is necessary to avoid such primary particles having small contact areas.

According to the present invention, the length in which the primary particles are linked on the section of the secondary particle is equivalent to 10 (preferably 50) to 70% of the length of the whole periphery on the section of the primary particles and the percentage content of Ni (y) is less than 50%, so that the relative lattice volume change rate decreases.

By satisfying these requirements, a lithium secondary battery using the positive electrode material in which the discharge rate characteristic and the battery capacity in the environment of the low temperature of -30°C are hardly deteriorated and which are excellent in a cycle characteristic can be achieved. One skilled in the art could not have thought the present invention having those three features based on Matsumoto et al. and Shiozaki et al. The object of the present invention is different from that of Shiozaki et al. The Shiozaki et al. publication does not teach the contact area among primary particles of the planar type in each secondary particle of the present invention.

For the foregoing reasons, the presently claimed invention is patentable over the proposed combination of Matsumoto et al. and Shiozaki et al.

Claims 14, 16 and 18 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Matsumoto et al. and Shiozaki et al. and further in view of Japanese patent application publication number 2001-085006. Applicants traverse this rejection and request reconsideration thereof.

The Examiner cites JP '006 as disclosing a positive electrode material comprising a lithium composite oxide in the form of primary flocculated into secondary particles in which the percentage of voids in the secondary particles is 2-30% or less, preferably 10-20%. However, it is submitted JP '006 does not remedy the other deficiencies noted above with respect to Matsumoto et al. and Shiozaki et

al. Accordingly, it is submitted claims 14, 16 and 18 are patentable over the proposed combination of documents, at least for the reasons noted above.

In view of the foregoing amendments and remarks, favorable reconsideration and allowance of all of the claims now in the application are requested.

To the extent necessary, applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to the deposit account of Antonelli, Terry, Stout & Kraus, LLP, Deposit Account No. 01-2135 (Case: 1021.43559X00), and please credit any excess fees to such deposit account.

Respectfully submitted,

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